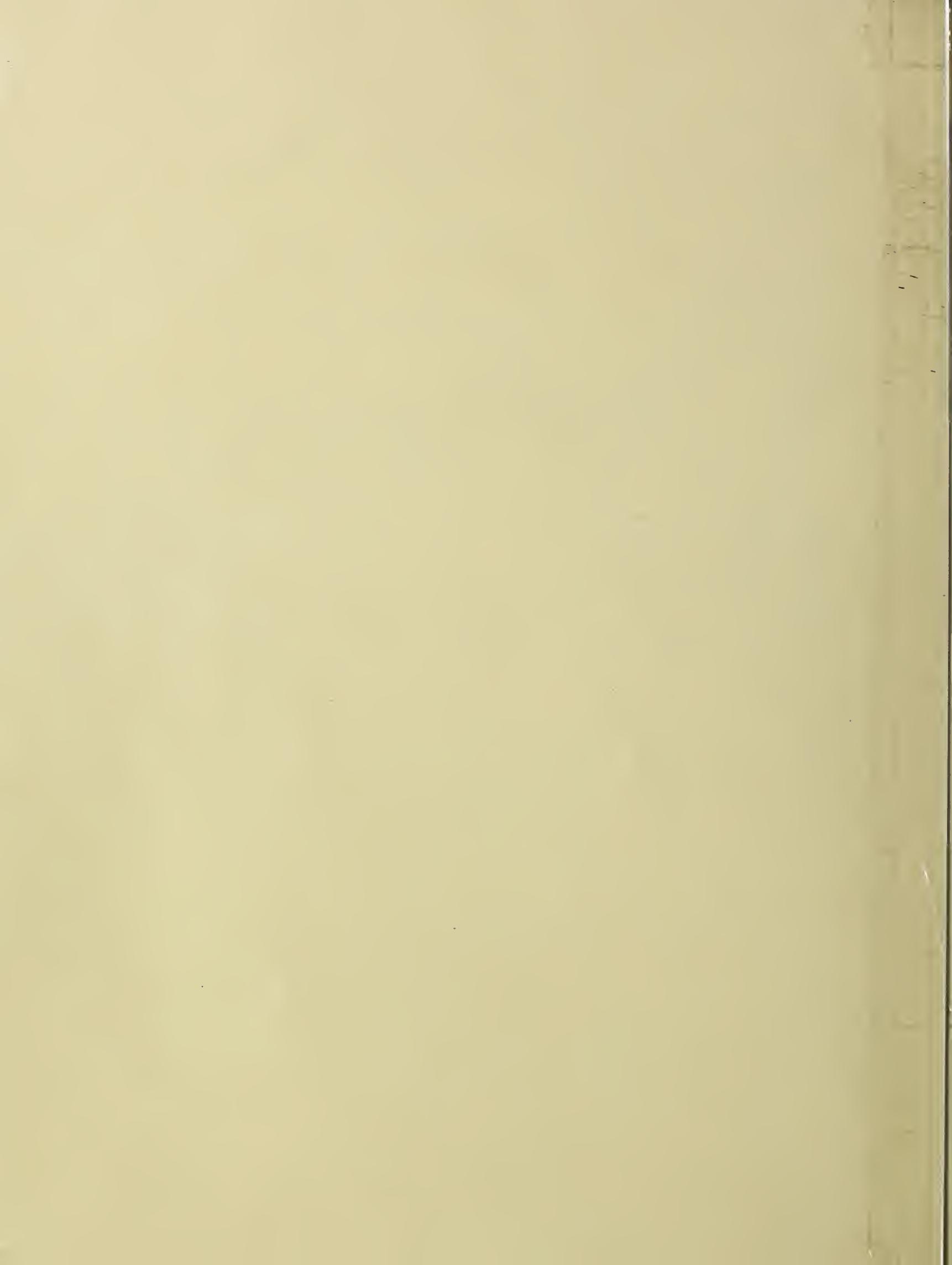


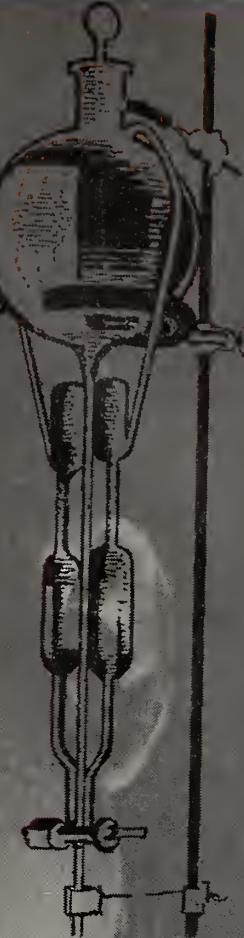
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protein finder
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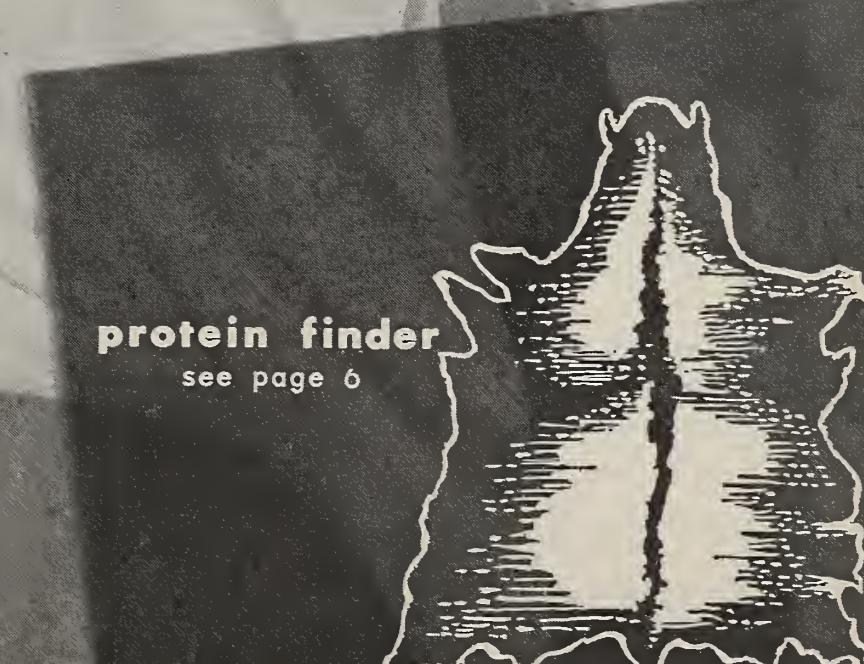


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DECEMBER 1957



lunch basis
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protein finder
see page 6

UNITED STATES DEPARTMENT OF AGRICULTURE

AGRICULTURAL Research

Vol. 6—December 1957—No. 6

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New Crops

One of the ways agricultural research can help bring supply and demand into balance is to develop new crops for land diverted from such commodities as cotton, corn, and wheat.

Best prospects are for plants that have possibilities as raw material for industry. One or two big-volume crops with industrial potential could do much to ease our surpluses.

Developing such crops is a many-sided operation.

First thing is to find them. Our scientists have stepped up their global search for new plant materials.

Then we screen our finds—study their chemical makeup to find their value as food, feed, or industrial products.

We next evaluate their market potential. Is there a market where the present supply of materials is short or undependable? Will growth call for an increasing supply of a material that farmers can produce? Can the plant-derived material compete with synthetics or products from foreign sources?

Now we are ready to start breeding suitable varieties, establish their areas of adaptation, and work out production and processing methods to put the crops to best use.

We are making progress in developing such crops.

One of the brightest prospects is the castorbean. Its oil has unique and valuable properties for paints, varnish, fungicides, and cosmetics. This oil yields sebacic acid, useful for plasticizers, coating materials, resins, and lubricants for high-speed machines. We all know how plant breeders reshaped the castorbean for machine production and utilized hybrid vigor to boost yields, how engineers developed machines for producing and harvesting the crop. With the right conditions, we might profitably grow a million acres.

Another promising oilseed crop is safflower, which yields oil high in versatile linoleic acid. Safflower is suited to land now in wheat and already is planted on 100,000 acres.

The structure of castor and safflower oils suggests that we might expect a vast number of new products from them.

Researchers are optimistic about the prospects for these and a number of other new crops. Success calls for an intensified research and development effort—plus time.

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looking back at . . . 1957

Cost-price relationship stays steady, farms get fewer and bigger; land values rise substantially

■ BOTH PRICES OF farm products and operating expenses of farmers have increased in 1957, whereas farm output has remained about the same.

For the first 9 months of 1957 as compared with the same period in 1956, farmers' cost rates are up about 4 percent and prices received for livestock and crops have increased 3 percent. This indicates, say USDA agricultural economists, little change in the cost-price relationship.

Prices paid for farm machinery, building and fencing materials, feeder livestock, and seed were above the 1956 average, as were farm wage rates and interest payable on farm mortgage loans. Fertilizer prices were about the same. Feed was lower.

Our farms are still decreasing in number and increasing in size. Investment per farm has gone up for all farms—averaging \$27,000 this year, according to ARS tabulations. An increase in farm assets to \$176.8 billion on January 1, 1957, is due mainly to the strength of the market for farm real estate. Farmland values increased 8 percent throughout the United States during the 12 months which ended with July 1957.

Value of irrigated land higher

The average value per acre is highest in several Northeastern States, where large cities add site value to farmland, and in the central Corn Belt and California. Values average lowest in the Mountain States because of extensive areas of arid grazing and

nonirrigated cropland. Irrigated land in these States has a value about 4.8 times that of the dry farmland—or as high as comparable land in many Corn Belt States.

The total acreage of cropland harvested in 1957 is about the same as in 1940. But the size of farms is up about 40 percent since 1940 and output per farm is up 74 percent. Compared to the 1947-49 average, production in 1957 was higher for livestock products, feed grains, hay and forage, oil crops, and fruits. Expansion in these items more than offsets a reduction in the output of food grains, cotton, and tobacco.

Man-hour production doubles

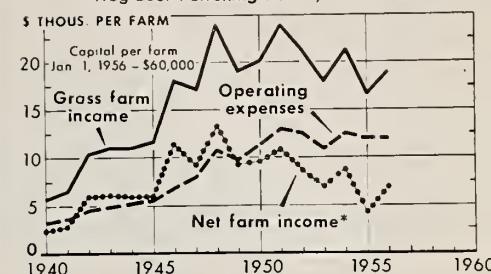
Farm production per man-hour has doubled since 1940, owing to rapid mechanization of farm jobs and application of improved methods. Man-hours worked on farms and the number of farm-family workers are down by a third, whereas total farm output is up 35 percent. The quantity of machinery now used per hour of labor averages two and a half times as high as in 1940. The average farmworker now produces enough food, fiber, and tobacco for himself and 20 others.

Increased labor productivity, technological advances, larger farms, greater output, and fluctuations in prices and costs are all reflected in farmers' annual income and expenditures. (Charts at right show income and expenses on five types of commercial family-operated farms.) ☆

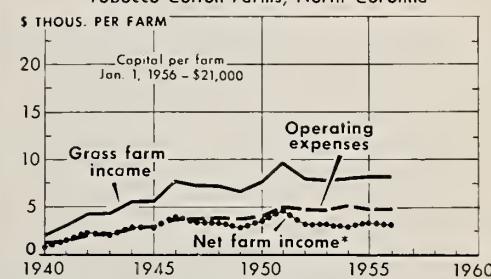
INCOME & EXPENSES

* return to capital and unpaid labor on commercial family-operated farms

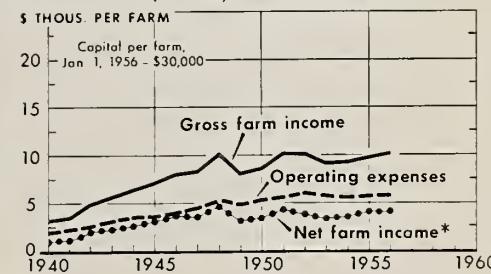
Hog-Beef Fattening Farms, Corn Belt



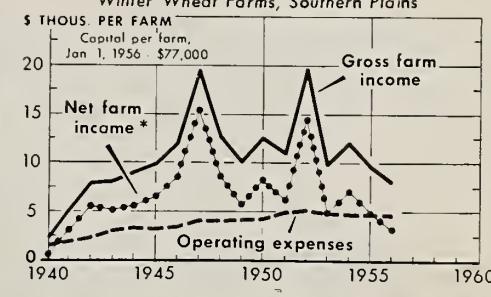
Tobacco-Cotton Farms, North Carolina



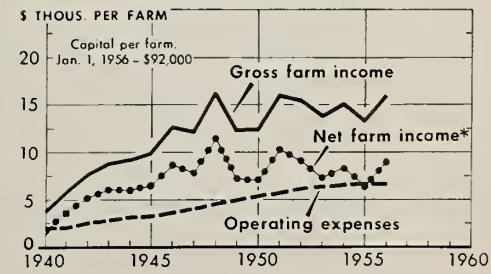
Dairy Farms, Central Northeast



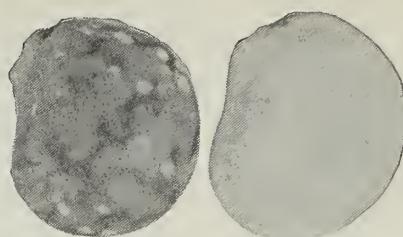
Winter Wheat Farms, Southern Plains



Cash Grain Farms, Corn Belt



Southern Grazing's Missing Link?



■ BORRE SWEET BLUE LUPINE—a truly nonbitter form of this legume, developed in Sweden and being tried out as a pasture plant in the Gulf States—may be the area's missing link in year-round grazing. New characters combined with Borre's sweetness by USDA and Georgia Agricultural Experiment Station scientists working cooperatively at Tifton may in a matter of years make this a more practical forage.

From central Georgia, south and westward to southern Louisiana, the area of adaptation, lupines make heavy growth in February, March, and April. Grazing of small grain must be stopped earlier to allow it to head. Permanent pastures aren't ready to graze until about May.

The lupines we've had were purely soil-improvement crops because of their high content of the bitter, toxic alkaloid known as luponin. Borre overcomes this—but still has a drawback. Like our most common lupines, it has gray, mottled seeds, purple stems, and blue flowers. Thus, variety mixing or substitution couldn't be detected. Cattle won't graze where as many as 5 percent of the plants are bitter.

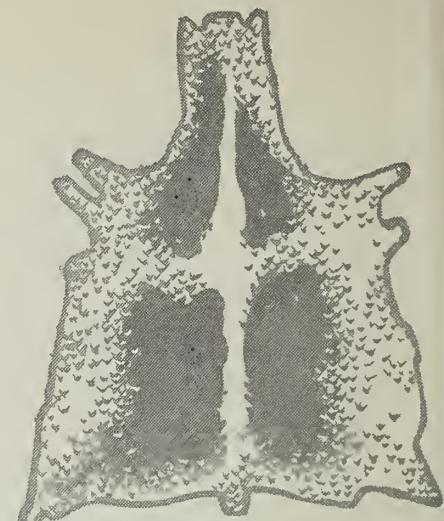
To meet this objection, ARS agronomist Ian Forbes and geneticist G. W. Burton combined in an experimental strain the sweetness of Borre and three new characters—*white* seed, *white* flower, and *green* stem—from a wild bitter strain from New Zealand. Those new characters are not found in any commercial lupines. In tests at Tifton and Florida Agricultural Experiment Station, the color characters invariably identified the experimental line in seed, early plant, and flower.

Forbes discovered and made use of a habit of an insect pest, to help select sweet plants from the many hybrids. Like cattle, thrips won't feed on bitter lupines. So Forbes rogued out uninjured plants, kept for study and increased only those with extensive thrips injury.

The new line is being increased to commercial quantities—several years' work. Meanwhile, Forbes and pathologist H. D. Wells have found in other wild strains some genes for anthracnose resistance and are trying to transfer these to Borre along with genes discovered by Florida agronomist J. R. Edwardson for resistance to gray leaf spot.

Bean-yellow-mosaic virus is reported by Florida pathologist M. K. Corbett to be the principal virus disease of the sweet *yellow* lupine used there for grazing. Scientists are searching for plants resistant to this virus, which reduces the seed yield. Irradiated yellow lupine and imported lines, varieties, and species of the genus *Lupinus* are being checked, but no source of resistance has been found.

In the meantime, Corbett and Edwardson have a possible method of reducing incidence of the virus in seed fields. The researchers found that aphids, the virus transmitters, can't retain the virus for over 10 seconds. A protective border of a nonsusceptible crop such as oats around the lupine field has been shown to increase seed yield.☆



■ DIALDEHYDE STARCH—a new, versatile, and potentially economical corn product—has substantial promise as a tanning agent. It is domestically available and highly reactive. It produces garment and glove leather with a unique combination of properties, and has other potential applications in the leather industry.

Researchers at USDA's Eastern Utilization Research and Development Division, Philadelphia, find that dialdehyde starch produces good leather when used as the only tanning agent. It can also be employed in combination tannages—a common practice—as a means of widening its range of usefulness.

Right now, we are completely dependent on other countries for tanning agents, importing about 240 million pounds a year. Chrome ore, the source of a chrome chemical universally used to tan light leathers for the upper part of shoes, is imported from Africa and other parts of the world. Vegetable tannins from bark and wood—blends of which are used to tan leather for the soles of shoes and for upholstery—come from South America, Africa, France, and Italy.

This agent's available here

Dialdehyde starch comes from a cereal crop that's always domestically available and frequently in surplus. This is an important consideration for emergencies, when most of our tannin supply might be cut off.

CORN TANNED THIS FINE LEATHER

A remarkable starch made of corn gives us a domestic tannin with superior properties

This new chemical was experimentally developed at the Northern Utilization Research and Development Division, Peoria, Ill., several years ago. Researchers there discovered a practical method of oxidizing corn starch into dialdehyde starch and began investigating applications in the textile and paper industries.

Tanning value quickly noted

P. A. Wells, Eastern laboratory director, recognized its potential tanning action. He and Joseph Naghski thus set out to determine its usefulness. Various aldehydes have long served as tanning agents. Formaldehyde, for example, has been used to tan specialty leathers on a limited scale for years. But the disagreeable smell of formaldehyde and the flatness and emptiness of the leather produced restrict its application.

ARS chemists E. M. Filachione, E. H. Harris, and M. L. Fein found that dialdehyde starch tans as rapidly as chrome in conventional equipment. They also found that starch-tanned leather accepts other tanning agents without complications, leading to desired combinations of properties. Lubrication of the leather with oils in "fat liquoring" is normal, dyeing level. The large dialdehyde-starch molecule gives greater weight and fullness than formaldehyde.

The scientists soon found that dial-

dehyde starch not only tans hides and skins but also has desirable properties in its own right. For one thing, it produces off-white leather, whereas chrome tanning produces blue leather. An off-white base is easier to dye into pastel shades, which are in demand for women's wardrobes.

Important, too, is the fact that dialdehyde-starch-tanned leathers are stable in mildly alkaline solutions such as soapy water. This means the starch-tanned leather can be washed without stripping the tanning material from the leather. This would cause it to revert to raw skin and dry out hard and bony. There's a big and growing demand for washable glove and garment leathers.

DIALDEHYDE-STARCH tanned leather is examined by (l-r) R. E. Lothrop, Assistant Secretary E. L. Peterson, E. M. Filachione, Joseph Naghski. Current fashions demand pastel leather goods, difficult for chrome and vegetable tannins without using excessive pigments in finish. Basic light color of new tannin may be great advantage.

Present products from sheepskins are good, but any improvement in the leather or simplification in its manufacture would be most welcome.

Even though the tannage is organic, it (like chrome) is light fast, which is unusual. Stability of the leather to light is thus limited only by dyes and oils used after tanning.

Starch resists perspiration

Dialdehyde starch used in combination with other tanning agents is showing resistance to perspiration, an important property for insoles. The military found in World War II that the insole failed first, necessitating repair of the whole shoe. Although this has been largely corrected by vegetable-chrome combination tannages, having a tannage that is domestically available gives added protection. A pretannage with dialdehyde starch shortens the time for tanning sole leather with vegetable tannins (a long and costly process).

Other applications are possible, but much remains to be done before they are realized. Cooperative work with tanners is already under way. We may see many quality products tanned with dialdehyde starch.★



measuring protein

2 EASY WAYS

These quick, simple techniques might find numerous uses in research, marketing

■ TWO FAST, RELIABLE, easy methods to measure protein in food products have recently been developed by USDA scientists. These methods take on added importance with growing emphasis on the value of protein in the diet. They may also help determine the quality of flour for bread.

One method, developed by ARS chemist A. J. Pinckney, of the Agricultural Research Center, Beltsville, Md., is based on the biuret reaction (biuret is a simple chemical substance). The other, developed by chemist D. C. Udy, of the Western Wheat Quality Laboratory, Pullman, Wash., is based on excess use of a dye.

Most common way to measure protein now is the well-known Kjeldahl method, which utilizes hazardous chemicals such as sulfuric acid. It actually measures nitrogen; from this, protein content is figured with no distinction between protein and non-protein nitrogen. It's fairly expensive, takes long to run, requires specialized equipment and techniques.

Here's how the new method that was developed by Pinckney works:

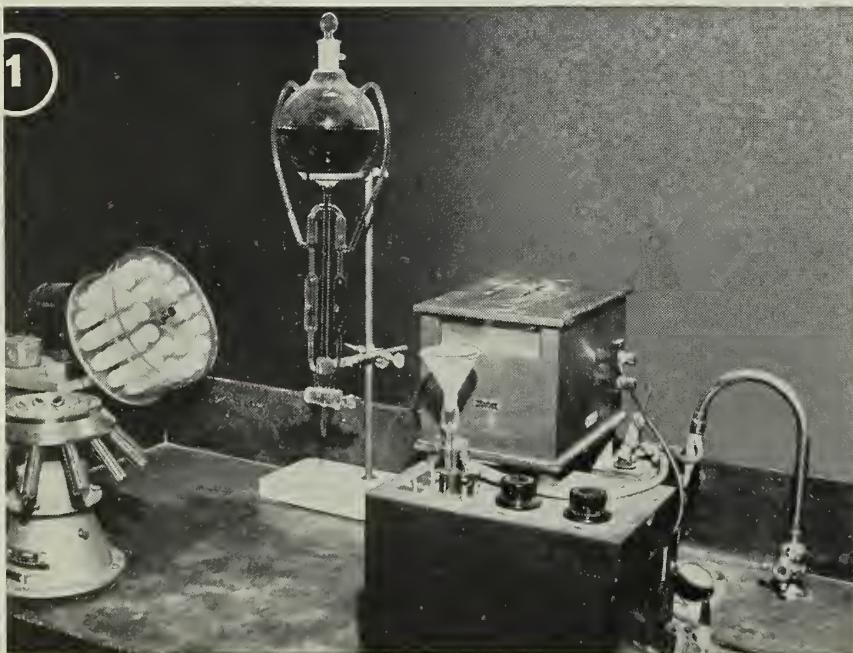
Biuret in alkaline solution is known to react with copper ions to form a

violet copper salt. Now it happens that *protein* in alkaline solution reacts with copper ions in the same way as does biuret. That's because biuret and protein have similar peptide linkages—portions of protein's long amino acid chain are linked together in the same way with the same elements. In each case, intensity of the violet color serves as a direct measure of protein.

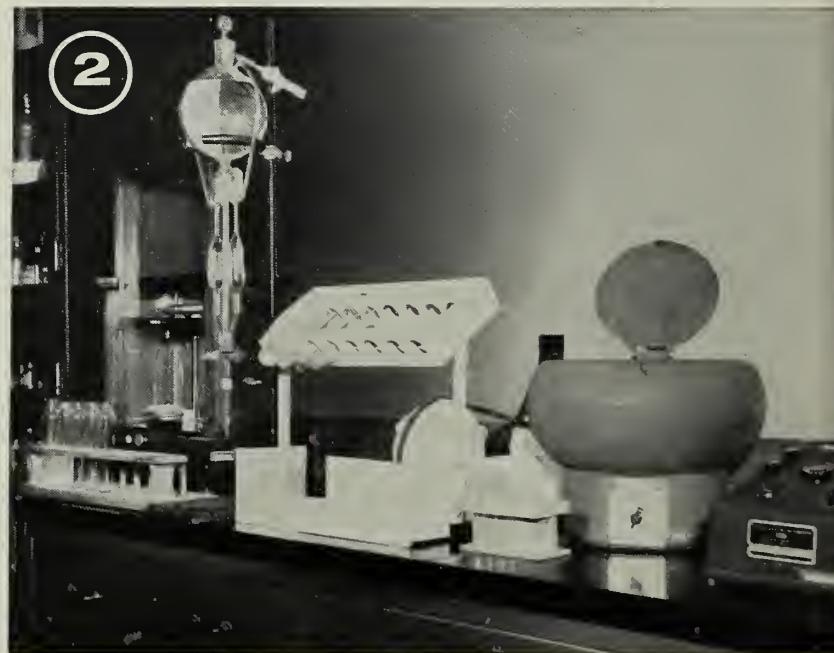
In actual practice, Pinckney first prepares the reagent—consisting of alkali, copper, and small amounts of glycerine. Glycerine stabilizes the copper so it doesn't precipitate as the hydroxide. Freshly ground wheat or flour samples are then treated with this reagent and the protein reacts with the copper ions to form a characteristic violet color. The intensity of this color is read in a colorimeter, and the readings are converted to protein values by means of charts that relate color to protein.

Biuret method is successful

This modification of the biuret test has been successfully applied so far only to wheat proteins but may work for other products. The test is more



ORANGE G DYE is used to bind protein in simple test worked out by Udy. Equipment includes (l-r) centrifuge, rotating shaker, automatic pipette, photoelectric colorimeter. Additional equipment for grinding, weighing is same as that used in present methods.



BIURET-TYPE test developed by Pinckney utilizes standard laboratory equipment, is easy to run. Basic pieces include (l-r) scales for precise measurements, pipette, shaker for thorough mixing, centrifuge, colorimeter. Test tubes, flasks are also used.

rapid and much less expensive than the Kjeldahl. In addition, only true protein content is measured.

Udy's method is based on a reaction between orange G dye (a water-soluble disulfonic acid dye) and proteins. The dye reacts with the protein molecules to form an insoluble complex—the protein is bound and cannot be broken down in solution.

G dye takes only 5 minutes

Knowing this, Udy mixes a known amount of orange G dye with the protein. Tubes are stoppered and then agitated to allow complete reaction between protein and dye molecules. The insoluble protein-dye complex and other insoluble flour components are separated from the solution by centrifuging or filtering. The concentration of unbound dye in the resulting clear supernatant solution is measured in a colorimeter. The protein content of the flour or wheat sample is related to the concentration of unbound dye. Therefore, protein content can be read directly from a table that was previously prepared.

A single protein analysis can be made within 5 minutes when the agitation step is carried out in a semi-micro electric blender container.

So far, the Udy method has been used effectively on wheat and barley products, and on dry and whole milk. It can be applied to many other products where protein is important.

Cost of chemicals and power is reduced by this method to about one-fifteenth that of the Kjeldahl method. It is at least twice as rapid. Hazardous chemicals are completely eliminated. It is adaptable to automatic techniques. And it measures native protein and not nitrogen.

Tests may have many uses

It may be possible to adapt these techniques for use in grain grading, grain and flour selection, and quality work with other products.☆

VIRUS TENT CATERPILLAR WEAPON



■ MAN-MANIPULATED VIRUSES have practically wiped out the tent caterpillar (*Malacosoma fragile*) in test areas on the Navajo Indian Reservation in the Chuska Mountains of New Mexico.

Last year, USDA's Forest Service and the California Agricultural Experiment Station sent entomologist Edwin Clark to New Mexico. Funds were provided by the Navajo Tribal Council, Window Rock, Ariz.

Clark worked with Forest Service entomologist C. L. Massey, the Navajo tribe, and the Bureau of Indian Affairs. Virus was sprayed over 6 plots, including a 2-mile-long strip of aspen that was infested with tent caterpillars. Considerable mortality was recorded.

To obtain the virus, Clark first raised insects in the laboratory. Then, in the field, he collected dead caterpillars with flaccid, liquefied appearance, indicating death from virus infection. Clark ground them, added water, and sprayed the foliage the laboratory-reared caterpillars ate. The insects contracted the virus and died in about 14 days. Batches of the dead insects were ground, placed in water, strained through a cheese cloth to remove impurities, and stored in jars. A pint of ground caterpillars is sufficient to spray 30 to 50 acres.

This summer, ARS entomologist Clarence Thompson went to New Mexico to help Massey analyze the results. At the reservation, they found a heavier mortality than last year. The effect of the virus had carried over the winter to the succeeding generation of caterpillars. Tests indicated that adults developing from caterpillars that survive virus applications may lay virus-contaminated eggs. Eggs transferred from virus-free areas to sprayed trees also became infected.

Thompson and Massey also went to New Mexico's Carson National Forest, where Clark and Massey had reported a natural outbreak of the disease. Last year, there was complete defoliation of aspen, and the trees were dying. Hundreds of colonies of tent caterpillars dying of virus were found in each tree. But this summer, no infestations were located, and streams in recreational areas were no longer contaminated with dead caterpillars. There were only a few scattered colonies.

Now USDA scientists want to find out how far the virus spreads in a treated area. They plan to spot-spray solid plots in designated sections separated by mountain ridges next summer. Then, the following year, surveys will be made to determine the extent of the spread. If it's found that the artificially applied disease spreads a considerable distance, the virus treatment would be economically feasible.☆

EGGS ARE LAID (right) by engorged female. Causative organism of fever, if present in host animal, is passed through eggs to seed ticks. They spread disease by feeding on cattle. Life cycle—egg, to 6-legged seed tick, to 8-legged nymph, to adult—may take 6 to 10 months in warm weather. Cattle in Florida's infested areas are dipped (below) in approved chemical concentration. Fifty to 100 per hour can be treated in 2,000-gallon vat. Subsequent regular dippings kill ticks that remain in pasture.



OUT GOES THE CATTLE FEVER

Dipping, inspection, and quarantine help against Florida's outbreak of this constantly dangerous disease carrier

■ EARLY ERADICATION of the cattle fever tick from Florida may be possible because of prompt action by the Florida Livestock Board and USDA in setting up inspection, quarantines, and systematic dipping of cattle and horses in the infested areas.

Barring complications, thorough dipping of animals in an appropriate tickicide at regular intervals over a period of 8 to 12 months should rid infested premises of this pest, according to fever-tick experts.

Known as the "Typhoid Mary" of the cattle world, the fever tick is the potential carrier of piroplasmosis, destructive blood disease of cattle. Although the disease has not appeared in the current infestation discovered in Florida in April, presence of the tick is a menace to cattle everywhere in the United States.

Cattle tick fever, also known as Texas fever, caused large losses in our early history. At the beginning of this century, it cost southern cattlemen alone \$40 million a year.

No satisfactory medical treatment has been developed for tick fever. But healthy cattle can be infected only by the tick, so getting rid of this carrier eliminates the danger.

How does the tick spread infection? After mating, a female engorged with blood from its infected host drops to

the ground and may lay as many as 3,500 eggs. She passes the infection through the eggs to her progeny—the seed ticks. On hatching, these six-legged parasites crawl up grass, shrubs, and fence posts, and attach themselves to passing host animals. As the ticks feed, they transmit the disease organism to the blood of the host. Remaining on the animal, see ticks change to eight-legged nymphs. They develop into mature ticks. The life cycle may be completed in 6 to 10 weeks in warm weather.

Seed ticks can live up to 8 months under favorable conditions. They can't crawl far, but they may be transported long distances by animals—cattle cars, trucks, and on hides. Infestation could be carried to cattle in any part of the United States.

Fever tick does other harm

Apart from being a disease carrier, the fever tick injures cattle by sucking large amounts of blood. Heavily infested animals became emaciate and unprofitable; dairy cows produce less milk; young animals are retarded in growth; and the hides of infested cattle bring lower prices.

Cattle-tick-fever research reported by USDA scientists in 1890 showed for the first time in medical history that an infectious disease could be

R TICK



TRAINED INSPECTORS examine cattle before dipping. Ticks found are studied for identification as fever ticks. If there is any doubt as to species, specimens are sent to central USDA laboratory for official check.



PAINT MARKING is placed on animals for identification as they emerge after swim through vat. Left shoulder is marked for first dipping, left side for second, left hip for third. Order is repeated on other side.

spread by ticks. Researchers then developed effective tickicides and treatment methods. These have been perfected through the years so that large numbers of cattle can be easily and economically treated.

Reinfestation remains threat

A 15-State tick-eradication effort begun in 1907 was successfully terminated in 1943. Only a narrow buffer zone stretching 550 miles along the Texas-Mexican border has remained under Federal quarantine, because of reinfestation by animals entering illegally from Mexico.

Florida's active commerce with the tick-infested West Indies exposes her to constant danger of reinfestation. Outbreaks previous to that of last spring occurred in the State in 1946 and 1948. Periodic infestations have also been found in California, which has a common border with tick-infested areas in Mexico. The most recent, occurring in San Diego County in June 1956, was eradicated by an official dipping program.

Conquest of the fever tick has brought about substantial improvement of southern cattle and has lifted the economy. In Florida, for example, the livestock industry's annual income of around \$140 million ranks close to the top in the State.☆

REPEAT inspection for fever ticks is made while treated cattle are held in dripping pen following each dipping. With animals' hair wet and flattened, ticks can be seen more readily.



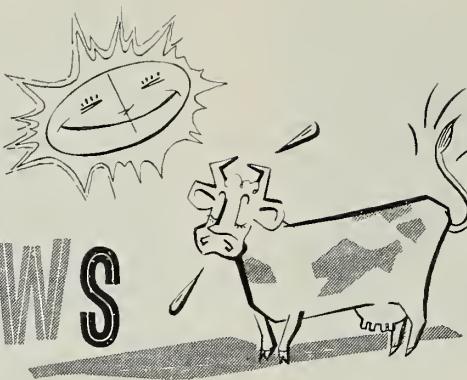
RANGE riders check herds carefully following each dipping to detect any animals that don't happen to carry current paint marking. This is necessary precaution to be sure all animals are treated.

ROADBLOCKS are used on highways out of areas under State quarantine. Permit showing animals are eligible to move is checked by quarantine officer to prevent exit or entry of untreated cattle.



NEW APPROACHES TO

COOL COWS



Crossing European breeds, selection within breeds, and crossing with Zebu types are backed by supporting work

■ NEW LINES OF RESEARCH to develop milk cows for warm climates have been jointly undertaken by dairy scientists of USDA and several State experiment stations in the South.

Under the newly adopted Federal-State plans, dairy cattle suitable for the South are being sought by (1) development of an adapted strain of high-producing cattle from a crossbred foundation, (2) use of systematic crossing to produce commercial cows adapted to the area, and (3) selection with European breeds of adapted animals for developing new strains from these breeds. Sire service for portions of this work is being furnished by members of the National Association of Artificial Breeders.

Zebu crossing supplemented

These approaches supplement 10 years of effort to develop high-producing, heat-tolerant cows by crossing Red Sindhi and other Zebu types with European breeds (AGR. RES., September 1955, p. 14). This phase, now being completed at some stations, will be carried on at the North Louisiana Hill Farm Experiment Station, Homer, and Texas Agricultural Experiment Station, College Station.

First phase of the new work has been initiated at Jeanerette, La., where a foundation herd of Holstein and Jersey purebreds has been established from other research herds. Top ani-

mals of Red Sindhi-Jersey crosses and purebred Jerseys were kept from the original Jeanerette herd, and eight Sindhi-Jersey crossbred cows have been brought in from the Federal-State project at Tifton, Ga.

Jeanerette cows will be mated to outstanding Brown Swiss and Holstein sires from artificial breeding associations in an attempt to pool the desirable characteristics. Each generation of crossbreds will be evaluated by comparing the offspring with contemporary purebred Holsteins.

Most of the work with systematic crosses of European breeds will be conducted cooperatively by the Georgia Coastal Plain Experiment Station. This phase was initiated last year in an effort to determine the value of possible hybrid vigor in developing commercial animals more adaptable to the South. The herd used will include 25 Jerseys, 25 Holsteins, 25 Brown Swiss, and 75 crossbreds. Present plans call for limiting initial matings to Holstein and Brown Swiss bulls with Jersey females.

Work covers present breeds

A third phase is now being conducted with Jerseys at Tifton and with Holsteins at Baton Rouge to determine the feasibility of developing adaptable strains from existing breeds. The animals will also be mated to outstanding sires used in

artificial breeding, to capitalize on genetic sources within these breeds.

Complementing the threefold program are supporting physiological studies, work on management and nutrition, and collection and analysis of weather data. Physiological studies at all stations comprise investigations of heat tolerance of dairy cattle by field and laboratory methods. These studies include sweating, heat production, skin temperature, and other factors that may cause variations in heat tolerance.

Management studies, in which ARS agricultural engineers are taking part, are being conducted at Tifton and embrace investigations of field shelters. Researchers at Louisiana State University are studying the value of soiling from the angle of comparing animals kept under shade and those pastured in fields without shade.

Related research conducted

A nutritional aspect of adaptability is being undertaken in Louisiana. Workers are comparing the value of summer plantings and permanent pasture as sources of feed. Successive plantings are used as they reach the optimum pasturing stage. The objective is to learn the extent to which heat production in dairy animals is reduced by grazing pasture in proper condition compared with high-fiber-content mature pasture. The latter is a heat producer because of the energy that's used in breaking down fiber during the digestive process.

A pilot study of weather data collection and analysis, underway at various cooperating stations for some time, shows that such information can be obtained without elaborate or expensive equipment. The study also points out the value of these records of the actual conditions under which animals lived at a station.

These studies will guide interpretation and application of research results on dairy cow adaptability.★

GAMMA RAYS

Radiation's effect on insects and infested produce is being tested with cobalt-60 unit installed in Hawaii



HOUSING radioactive unit is concrete-block building, in 30- by 40-foot enclosure. Should 4-ton unit need repair, metal roof would be lifted off, unit would be taken out by crane and placed in well (left) in 10 feet of water. Trained workers would make repair there with remote handling tools.

A RADIOACTIVE cobalt-60 unit is an important addition to entomological research facilities at USDA's Fruit Fly Laboratory, in Honolulu.

It will be used to find out if penetrating gamma rays of radioactive cobalt will eliminate or render harmless fruit-fly infestation in fruits or vegetables. This could lead to a practical quarantine treatment.

It should also show whether releasing radiation-sterilized insects, a method used to eradicate the screw-worm on the Caribbean island of Curacao, can help to control fruit flies.

Encased in nearly 4 tons of protective lead, this 400-curiel unit can provide approximately 90,000 roent-

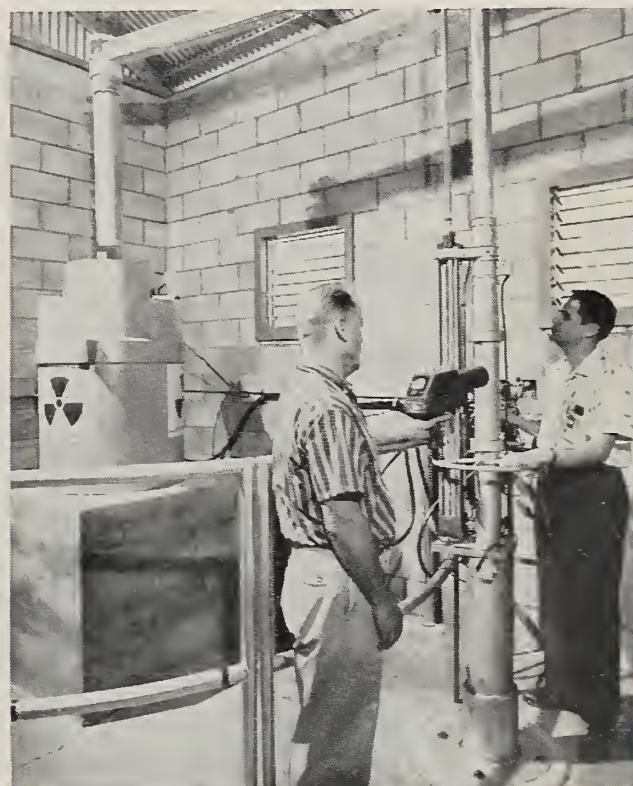
gens of ionizing radiation per hour. The "hot" inner chamber is large enough (5 inches in diameter and 11 inches long) to treat fruits as big as papayas and mangoes, or thousands of immature fruit flies.

The new facility, housed in a special building on land provided by the University of Hawaii, was nearly 2 years in planning and construction.

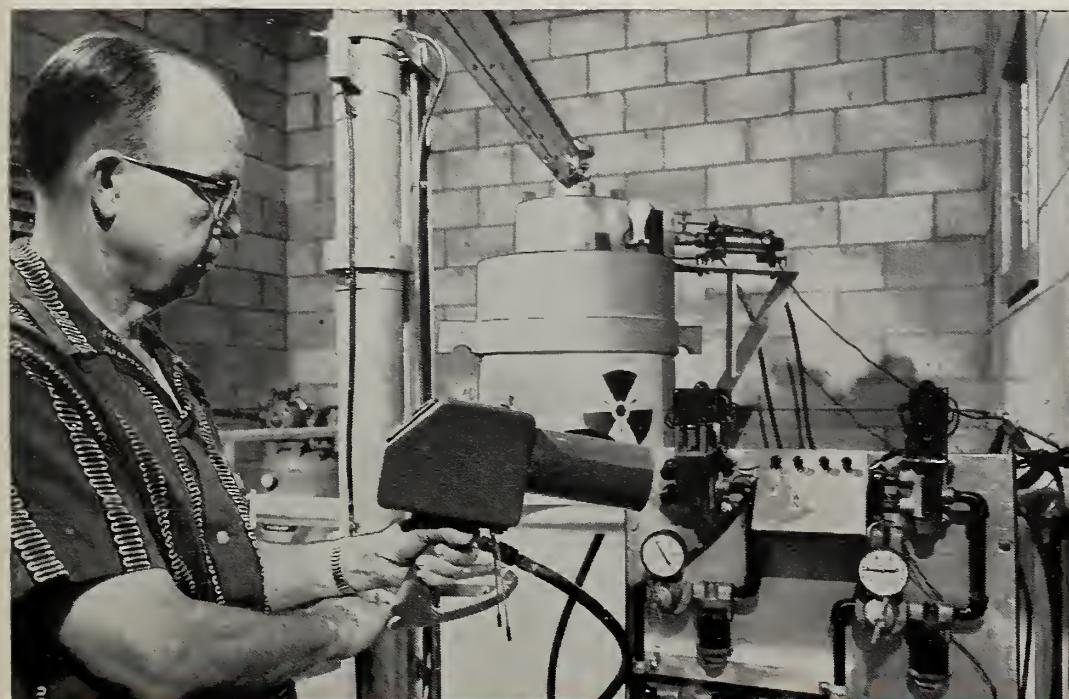
It's the outgrowth of promising results from preliminary studies with a 1-curie cobalt-60 gamma-ray source. This work was done by ARS entomologists L. D. Christenson, L. F. Steiner, and J. W. Balock, with G. O. Burr, of the Hawaiian Sugar Planters Association Experiment Station.☆

VS. FRUIT FLIES

CANISTER at upper left, containing fruit or insects to be treated, is lowered by crane into thick-walled lead cylinder holding cobalt 60. Entomologist J. W. Balock (left) checks radiation to be sure operator, entomologist A. K. Burditt, Jr., is working in safe limit. Lead plug (just above canister) seals top of unit when canister is inside. Crane, turned by wheel Burditt is grasping, moves canister left to guard rail so test material can be placed inside.



CONTROLS are monitored by engineering designer J. W. Mullins before use. Pressing "open" button on panel pulls air-pressure-operated lead shutter away from unit (see upper right); electric light warns unit is open. Shutter must be withdrawn to insert or remove canister. Two buttons on left of panel are used to raise or lower crane by air pressure. Time that test material stays in unit determines amount of radiation it gets. For precise dosage, scientists put material in canister with regard to exact location of radioactive cobalt 60 in unit.



EMPTIED PLATES show this meal passed final taste test. Many recipes, after trained taste panel has approved them at 100-portion size, are tried out in cooperating school lunchrooms. Children's reactions are carefully noted, including refusals or food left on plates. Preparing dish under actual school-lunchroom conditions may show ways to improve methods.



**Work on recipe development,
menu planning, nutritive value,
food use aided in success**

OUR RESEARCH-BASED SCHOOL LUNCH



PLATEFULS of well-prepared foods—protein dish, vegetables, fruits, along with bread, butter, milk—meet requirements of type A lunch and provide nourishment for hard study and play. Researchers provide school-lunch managers with menu suggestions, recipes, lists of best food sources of vitamins A and C, shown by surveys to be lacking in many diets. Other helps include buying guides, and layouts for kitchen, storage, serving units.

■ THE LITTLE REDHEAD's eyes sparkled. "Oh, yes, we have a good lunch at our school. Today, we had meat, carrots, salad, apple sauce, and bread and butter. We always have milk, and sometimes we have orange juice, too. All the kids like it."

The good lunch is no accident. For many years, USDA nutritionists and food specialists in ARS and Agricultural Marketing Service have studied children's food preferences and nutritional needs. These scientists perfected recipes and menus especially adapted for school lunchrooms. The Fish and Wildlife Service (U. S. Department of Interior) cooperated in developing fish recipes.

For example, researchers recently studied nearly 700 typical school-lunch menus from different parts of the country to discover which foods and food combinations were used

EXACT WEIGHTS and measures of ingredients as well as preparation methods are important in standardizing a recipe. Family-size receipts for dishes approved by tasters are enlarged to yield 25 portions, then 100—used in most school kitchens. Evaluation at each step guides researchers.



most often—as a possible reflection of local preferences. Most-often-used items were included in many of the menus in USDA's PA-271, "Recipes—Type A School Lunches."

Large-scale recipes devised

The 350 recipes were tested and standardized up to the 100-portion size. Their palatability was rated by trained tasters and, in many cases, by children in cooperating schools. Suggestions from cooks and managers helped make recipes practical.

Further aids developed by USDA researchers for school-lunch managers are the publications "Planning Type A School Lunches" and "Food Buying Guide for Type A School Lunches." The first explains steps in menu planning; the second shows the amounts of foods to buy.

To keep the nutritive value of lunches up to the best we know, USDA researchers check adequacy of meals from time to time—by chemical analysis or by calculating nutritive value from food-composition tables. Amounts of the key nutrients in the meal are compared with Recommended Daily Allowances of the National Research Council. Sometimes groups of children are examined to determine their nutritional status and discover their food needs (AGR.ES., September 1954, p. 8).

TIME REQUIRED to roast chicken or other meat, or to cook frozen meat, is given in minutes per pound at a specific temperature. Figure is an average from a number of studies using thermometers or thermocouples inserted into thickest part of meat. These show when interior meat has reached desired temperature. Here, researcher is marking the finish time on potentiometer chart, which records thermocouple responses.



Results are translated into improved menus and suggestions for school-lunch managers. For example, research done in 1952 on the type A meal pattern focused attention on the fact that many lunches served were lacking in vitamins A and C. This resulted in an educational program to encourage the serving of a vitamin-C-rich food daily (since the body does not store this vitamin) and a vitamin-A-rich food twice a week.

USDA research on school lunches began early in the history of the former Bureau of Home Economics—now the Institute of Home Economics. Cooperating with the Washington Child Research Center, workers studied nutritive needs, food habits, and tastes of young children.

During the depression, home economists developed menus and recipes to help school-lunch workers prepare and use donated foods available under USDA surplus-removal programs. When the 1936 Nationwide Dietary Survey showed that one-third of our families did not have good diets—later reflected in statistics on draft rejections—new emphasis was put on school-lunch nutritive value.

Nutritional standard set up

During the war, instead of distributing foods to schools, USDA reimbursed sponsors for foods purchased

locally. Eligibility for Federal aid was based on the quality of the lunch served—and the lunch pattern that had evolved through the years was adopted in 1943 as the standard.

The National School Lunch Act passed in 1946 provided that "lunches . . . shall meet minimum nutritional requirements . . . on the basis of tested nutritional research." The Secretary of Agriculture designated the type A pattern as meeting such requirements. (This pattern is designed to meet from one-third to one-half of a child's daily dietary needs as recommended by the National Research Council. As in the earlier years, it calls for specified amounts of a protein-rich food, vegetables, fruits, whole-grain or enriched bread, butter or fortified margarine, and milk.)

Special problems get study

Other research has been done on special problems, such as how to can or freeze surplus foods in school lunchrooms when more food is available than can be used immediately.

Are school lunches worth all this effort? Our little redhead and many like her give an answer, and growth over the years confirms it. From a few pupils in 1926 to 1 million in 1936, to 6 million in 1947, to 11 million in 1957—that's the story of our research-based school lunch.★

HOW MUCH FOOD to prepare for given number of servings is of concern to every school-lunch manager or cook. To aid them, researchers compiled data on yield of edible food from quantities as purchased, using best available information. Many institutions contributed figures obtained under actual feeding conditions. This researcher is separating and weighing light and dark meat, bones, skin, giblets, drippings from cooked chicken.



From Fats: a substitute for imported cocoa butter

■ MODIFIED FATS FROM EDIBLE domestic oils now in surplus may further replace cocoa butter—high-priced imported fat with unique characteristics. (Cocoa butter is the pure fat pressed from ground or crushed cocoa beans. It's widely used in candies and cosmetics.)

Researchers at USDA's Southern Utilization Research and Development Division, New Orleans, and the Quartermaster Food and Container Institute, Chicago, recently prepared several such modified products from animal and vegetable fats. These products generally had the same qualities as the more expensive cocoa butter.

Cocoa butter has several qualities that make it especially useful for making high-grade candies. At temperatures below 72° F., it is hard and brittle. Yet it melts in the mouth with a pleasing, cooling sensation. It softens and melts over a much smaller temperature range (or plastic range, as chemists call it) than other fats and oils. And it stores well for a long time.

ARS chemists R. O. Feuge and N. W. Lovegren chemically modified mixtures of oleic, palmitic, and stearic acids, then crystallized them. The resulting products—known as oleopalmítostearins, oleodistearins, and oleodipalmitins—proved to be just as good as cocoa butter.

Another satisfactory cocoa-butter-like fat was made by chemically modifying hydrogenated cottonseed oil and olive oil, then crystallizing out the desired product.

All the products mixed well with cocoa butter. Any cocoa-butter substitute would most likely be used in combination with cocoa or chocolate liquor (thick sirup). Therefore, the substitute fat and the fat in cocoa or chocolate liquor must be compatible—must not change softening or melting characteristics of each other.

Development of a good cocoa-butter-like fat from domestic oils is desirable in many respects. Cocoa butter has always been expensive. A confectionery fat from cheaper domestic oils should make premium grades of candies more readily available. In addition, such a fat could be easily modified to obtain certain qualities that even cocoa butter does not have. Cocoa butter, for example, has too low a softening point for summertime candies. A substitute that resembled cocoa butter but had a higher melting point would find wide tropical use by the Armed Forces. Work on this is underway.

The Army Quartermaster is already buying survival-ratio candy bars containing a special high-melting fat. Such fats now being used need to be improved.☆

From Fruit: rich-flavored homemade jellies, jams

■ HOMEMAKERS CAN MAKE superior flavored jellies and jams based on formulas worked out in USDA's Institute of Home Economics. With these recipes—which include pectin—fully ripe fruits with rich flavor as well as fruits low or lacking in natural pectin can be utilized. Moreover, the fresh flavor is retained and yield is greater.

Formulas were developed by ARS food specialists Gladys L. Gilpin, Jessie C. Lamb, Mildred G. Staley, and Elsie H. Dawson. They combined various liquid and powdered pectins with apples, blackberries, cherries, currants, grapes, peaches, plums, and strawberries. Cooperating homemakers tried out the successful formulas to check their dependability under home conditions.

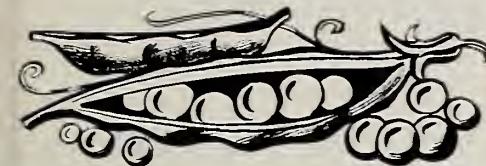
Jellies were rated by a trained taste panel for firmness, flavor, and general acceptability. Acidity, soluble solids, and evaporation losses were also determined chemically. Firmness was rated mechanically by measuring resistance to a "paddle tester" turning in the jelly. The ratings agreed closely with the taste panel's firmness scores.

Researchers gave special attention to the effect of cooking procedure on quality. They found that jellies were satisfactory when made at heating rates—either fast or slow—likely to be used with home-type electric or gas ranges. For large lots (6 cups of juice), however, fast heating to the boiling point gave a more desirable product than slower heating. Boiling 1 minute resulted in the preservation of delicate fruit flavor and a higher yield of jelly than boiling for 2 or 3 minutes. Lot size and cooking time were interrelated; small lots (2 cups of juice) were nearest optimum firmness when boiled for 1 minute, whereas larger lots were improved in firmness when they were boiled for 2 or 3 minutes. But it would probably be better to increase the proportion of soluble solids in larger lots and retain the short boiling time than to use a longer heating period.

Homemakers' directions incorporating these findings are given in USDA Home and Garden Bulletin 56, "How To Make Jellies, Jams, and Preserves at Home."☆

Dehydrofrozen peas

Dehydrofrozen peas may find a large market in restaurants, according to a recent USDA marketing test in Milwaukee, Wis. One hundred operators there compared prepara-



tion, handling, and quality of the new product with ones generally used. The peas reconstitute in cooking to look and taste fresh. Restaurateurs and consumers liked their quality.

The dehydrofreezing process, developed by the ARS Western Utilization Research and Development Division, Albany, Calif., removes about two-thirds of the water from peas and then freezes them. That cuts volume and weight by half and saves enough on transportation and storage to offset the cost of dehydrofreezing. The reduced need for freezer space is a big advantage to restaurateurs.

Restaurant owners participating in the marketing tests conducted by the Agricultural Marketing Service agreed that dehydrofrozen peas are as easy or easier to prepare than other kinds. The new product looks good and stays fresh and flavorful after a long time on the steam table.

New rice disease in Florida

A survey of infestations and a cleanup campaign have followed discovery of destructive hoja blanca rice disease near the Everglades Branch of Florida Agricultural Experiment Station, Belle Glade, last summer. The disease, believed a virus type, causes yellowish-white streaks on leaves, reduces heading, and cuts production of rice by as much as 25 percent.

Florida grows little rice, but the disease symptoms were observed in the Belle Glade area on two grasses that grow widely in the South. Scientists are concerned about the possibility of hoja blanca reaching the centers of our \$200-million rice crop.

Infested areas located by the Florida Plant Board and USDA have been sprayed to kill infected grasses and destroy suspected insect carriers, and the infected rice plowed under.

USDA has located 285 lines of rice with appreciable disease resistance in its world collection of rices—but no commercial varieties and none of the important long-grain type.

Extend nematode curb

USDA's quarantine to control the soybean cyst nematode was extended to three more States October 10. New regulations cover only the Mississippi River bottoms from the levee to the State line in Crittenden and Mississippi Counties, Ark.; in De Soto County, Miss.; and one farm in Fulton County, Ky.

Certificates or permits are required for interstate movement from the areas of live soybean cyst nematodes or articles likely to harbor them—root crops, bulbs, nursery stock, other plants with attached roots, soil, ear corn, soybeans, small grains, hay, straw, fodder, plant litter, seed cotton, used farm or construction and maintenance machinery, used sacks or other containers for farm products.

Jubilee at Ohio State

Leading scientists from this country and abroad helped celebrate the diamond jubilee of Ohio Agricultural Experiment Station, in Wooster, on October 14, 15, and 16. They took

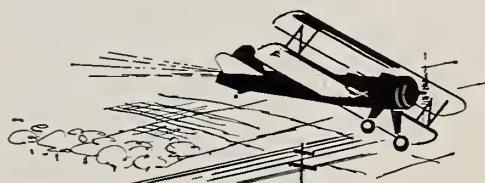
part in a symposium—sponsored by the Ohio Station and Kettering Foundation—on the role of trace elements in plant and animal nutrition.

Principal speaker was C. F. Kettering, of the foundation. Other speakers were from USDA, the Argonne National Laboratories, the Rockefeller Institute, various State universities and private institutions, and from Australia and France.

Pushing back two pests

Plans for an attack to eventually wipe out two of the most costly insects that plague agriculture in the South—the imported fire ant and the screwworm—have been developing between USDA and State agencies. Funds for this purpose were made available by the 85th Congress.

The attack already is underway against the imported fire ant, a pest that infests more than 20 million



acres in Texas, Alabama, Mississippi, Louisiana, Florida, and Georgia. Isolated infestations exist or have been eradicated in North Carolina, South Carolina, Arkansas, and Tennessee. The imported fire ant is harmful to crops, livestock, and humans.

Most effective time for field operations against the fire ant is from November to April. Every effort is being made to carry on an aggressive eradication program at the optimum time within the limits of funds available to USDA and from States, local agencies, and property owners.

To stamp out the fire ant, which may take 3 years or more in a given

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area, all infested lands will need to be treated, regardless of ownership or use. Insecticides effective against fire ants include dieldrin and heptachlor. Chlordane is effective but requires twice as much to kill the pest and has less residual value under most conditions. Application will be by aircraft, motorized ground equipment, and hand applicators.

The screwworm, a pest that causes heavy losses among livestock and wildlife, will be attacked in Florida and parts of Georgia, Alabama, and South Carolina. Male screwworm flies sterilized by gamma rays from radioactive cobalt will be used. When normal screwworm females, which mate only once, mate with sterile males, their eggs do not hatch. Feasibility of the method was shown by field tests on the island of Curaeao, and in Florida last summer.

Before an all-out screwworm campaign can begin, mass-rearing facilities for flies must be prepared.

With both the screwworm and the fire ant, quarantines will be needed to protect areas cleared of the pests and to keep them from spreading.

Name policy advisers

Four agricultural leaders were appointed to USDA's Agricultural Research Policy Committee by Secretary Ezra Taft Benson, October 14.

They are P. S. Armstrong, of Los Angeles, retired general manager of Sunkist Growers, Inc.; H. B. Caldwell, of Greensboro, N. C., master of the

State Grange; Dr. C. B. Lyon, of Philadelphia, chemicals-research director for Rohm & Haas Corp.; and L. Getting, of Sanborn, Iowa, a lamb and cattle feeder and farm leader.

The appointees replace Roy Battles, Homer Brinkley, Frank J. Haumont, and Dr. C. G. King, who recently retired from the 12-man committee.

The committee was formed under the Research and Marketing Act of 1946 to advise USDA on research and service work and seek the cooperation of producers, farm organizations, industry groups, and State and Federal agencies in carrying out such work.

Trench silage costs less

It cost a fourth more on 71 Alabama farms to harvest, store, and feed silage using an upright silo than with a trench silo—\$5.18 a ton compared with \$3.93. But there was 2.3 percent more spoilage in the trench silo. This was learned from a cooperative study in four counties by USDA and Alabama Agricultural Experiment Stations.

The biggest item—harvesting cost—varied by type of machine and type of silo used. For trench silos, it cost \$2.12 per ton with field forage harvesters, \$2.73 with binders, and \$2.82 with mowers—averaged \$2.43. For upright silos, it cost \$2.70 per ton with field forage harvesters and \$2.94 with binders—averaged \$3.44 including a few mowers used.

W. F. Gregory, ARS agricultural economist at Auburn, found that idle

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machines—idle 20 percent of the time overall and much more than that on individual farms—were an important



cost factor. On many farms, cost can be reduced by more efficient organization and use of machines and men.

Feeding cost was 96 cents from upright silos, \$1.23 from trenches.

ARS scientist gets award

The 1957 Borden Award for outstanding poultry-science research was awarded to ARS biologist B. R. Burmester, Regional Poultry Research Laboratory, East Lansing, Mich. The award—\$1,000 and a gold medal—is based on outstanding research since 1950 on visceral lymphomatosis, cancerous disease of poultry.

Burmester showed that lymphomatosis is virus produced. He also demonstrated that there are normally appearing "carrier" hens and that injecting dams with the virus may cause passive immunity in chicks (AGR. RES., June 1954, p. 4; November 1954, p. 4; April 1955, p. 6).

The scientist has been with USDA for 17 years. During that time he has received many honors for his work. These include the Poultry Science Research Prize in 1940, the Sigma Xi Research Award in 1948, the Tom Newman Memorial Award (International) in 1956, and the USDA Superior Service award.